REMARKS

The Applicants have now had an opportunity to carefully consider the Examiner's comments set forth in the Office Action of February 21, 2008. Claims 1-3 remain in this application. Claim 1 has been amended herein. No claims have been cancelled or withdrawn. Reconsideration of the Application is respectfully requested.

The Office Action

Claims 1-3 were rejected under 35 U.S.C. § 101 as not producing a useful, concrete and tangible result.

Claims 1-3 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Christiansen et al. (U.S. Pre-Grant Publication No. 2004/0114170) in view of Kobayashi et al. (U.S. Pat. No. 6,101,576).

The Present Application

By way of brief review, the present application addresses the continuing need for faster printing systems – particularly those where every page can be in different colors. More particularly, the subject invention comprises a method of improving efficiency of rasterizing image processing through a new implementation of parallelism. Prior implementations of parallelism in printing systems had been limited to job or page parallelism. However, job parallel processing results in poor single job performance, unpredictable job time and reduced throughput when there is only one long job in the queue. Page parallel processing is inefficient because per job overhead occurs on a per page basis. Either form of parallelism presents significant disadvantages in efficiency.

The method of the subject invention comprises a unique implementation of parallelism which Applicants have named "chunk" parallelism, an intermediate level of parallelism between job parallelism and page parallelism. A chunk is a collection of data describing an integer number of pages consisting of at least one page and not more than one job. This allows startup overhead in processing to occur on a per chunk basis, rather than on a per page basis, but prevents a single large job from reducing

performance. The subject invention implements chunk parallelism in such a way as to increase the efficiency of rasterizing image processing in a print system by tending to achieve an equal amount of processing work between parallel processing nodes in the print system, keeping multiple processors busy on a given job.

A preferred embodiment of the subject invention is a printing device comprising plural parallel rasterizing image processing nodes. Chunk size is determined by splitting factors for enhancing page processing efficiency. The splitting factors comprise either a threshold boundary of a number of bytes or a threshold boundary of a number of pages. In processing, the end of a chunk is the next page boundary after crossing a threshold boundary. The threshold boundaries for the number of bytes and the threshold boundary for the number of pages are determined for tending to achieve an equal amount of processing work between the plural processing nodes per boundary, and for keeping multiple processors busy on a given job, respectively. It is therefore, the flexibility of chunk size that gives chunk parallelism a significant advantage in efficiency over other forms of parallelism.

A key feature is virtual disk (VDISK) **38**, which is used for temporary storage, both of split chunks and print-ready pages. VDISK is similar to RAM disk with some specific features designed for performance in the contemplated chunk parallel system.

VDISK appears to both the sending and receiving processes like regular disk, with the ability to open files and directories, read and write files, etc. Unlike regular disk, VDISK provides the functionality that it may include a remote transfer (if the receiving process is on another node in a networked system), and because it knows whether the sending process has "closed" the file, it knows whether the receiving process should receive an end of file signal or be blocked on an attempt to read beyond the last data written. VDISK is implemented by a process providing a shared-memory interface for the receiving process, for local accesses. The VDISK implementation provides for more data being written to VDISK than fits into memory by paging out blocks of data in a most-recently-used order, because the least recently used (written) pages will be needed (read) soonest. Other than providing a transparent networked file system interface, blocking reads before end of file, and most-recently-used paging, VDISK operates much like a conventional RAM disk.

The Cited References

In contrast, Christiansen et al. is not concerned with an intermediary virtual disk transfer system. Instead, Christiansen et al. merely states that communication is conducted via the "local interface" which may be a data bus or an appropriate network. (Paragraphs 28, 32 and 35). Transfers occur directly between the local memories of the raster image processing (RIP) manager and the RIP engines. Furthermore, under Christiansen et al. each RIP engine maintains a local copy of the entire print job. As such, splitters are not used. Transfers of the entire print job are made to each RIP engine assigned a subset of said print job. Lastly, Christiansen et al. does not store job chunks in an intermediary virtual disk transfer system. It only stores, at most, print jobs, print-ready partitions, and print-ready print jobs in local memory. (Fig. 2)

The cited patent to Kobayashi et al. is directed towards a method for saving generated character image data in a cache system. The Office Action stipulates that Christiansen et al. does not explicitly disclose a method wherein the memory is a virtual disk transfer system, comprising monitoring available space in the virtual disk transfer system including detecting a data overflow in the RAM and storing new data in the physical disk until data storage in the RAM is available. Kobayashi et al. is relied on for disclosure of this subject matter. Kobayashi et al., however, does not disclose any method where memory is used in a virtual disk transfer system. Kobayashi et al. instead discloses a local caching system. The local caching system does not allow the remote transfer of print data, but is comparable to a local RAM disk.

The Claims produce a Tangible Result

Claims 1-3 were rejected under 35 U.S.C. §101 as not producing a tangible, real-world result.

The Examiner asserts that claims 1-3 achieve no tangible final result. Since claims 1-3 discloses a method for parallel processing and converting a print job into "a printer-ready format for printing the print job," it follows that the Examiner is also asserting that a printer-ready output format is not tangible or real-world. Applicant has thoroughly reviewed the Examiner's arguments and respectfully finds them to be

unpersuasive.

The tangible requirement requires the process claim to set forth a practical application that produces a real-world result. MPEP 2106 IV.C.2(2)(b). A printer-ready format is a tangible and real-world result. Every print job that is submitted to a printer must be rasterized to a printer-ready format. Since every print system must rasterize a print job into a printer-ready format, a method that increases the speed and efficiency through which this process is performed is practical. Claims 1-3 assert such a method.

Furthermore, when functional descriptive material is recorded on some computer-readable medium, it will be statutory in most cases. MPEP 2106.01. Functional descriptive material consists of data structures and computer programs which impart functionality when employed as a computer component. *Id.* A print-ready format does impart functionality when employed as a computer component because a printer is a computer and a print job in a print-ready format is a computer program for a printer. By employing a print-ready format as a component of a printer (computer), the functionality of said printer may be realized. The printer reads the printer-ready format and computes how to control the mechanical components and produce printed pages.

The printer-ready format is stored on a computer readable medium because the printer-ready pages are stored on a virtual disk. The virtual disk is comprised of a RAM and a hard drive which are both computer readable medium. Even if the printer-ready pages are not stored in the virtual disk, they will be stored in a buffer. Said buffer will comprise of at least some computer readable medium because the data in the buffer will need to be read by the computer at some time. Accordingly, inherent in the limitations of claims 1-3 is the limitation that the printer-ready format is stored on a computer readable medium. The print-ready format described in claims 1-3 is thus statutory.

For at least the foregoing reasons, claims 1-3 result in a tangible, real-world result.

<u>The Claims are not Obvious</u>

Claims 1-3 were rejected under 35 U.S.C. §103(a) as being unpatentable over Christiansen et al. in view of Kobayashi et al.

Even if the references were combinable, they do not teach, suggest or motivate such a method. Christiansen et al. does not teach or suggest an intermediary virtual disk transfer system. Instead, Christiansen et al. merely states that communication is conducted via a "local interface" which may be a data bus or an appropriate network. (Paragraphs 28, 32 and 35). No mention of a virtual disk transfer system is made.

Applicant has thoroughly reviewed the Examiner's argument with regards to the virtual disk transfer system of Christiansen et al. and respectfully believes the Examiner to be mistaken. The Examiner mistakenly asserts that the local memory of the RIP manager of Christiansen et al. is a virtual disk transfer system. While the local memory of the RIP manager is used to store and transfer print data to and from the RIP engines, respectively, it lacks several crucial features of a virtual disk transfer system. The virtual disk transfer system provides a transparent networked file system interface and blocking reads before end of file. By providing said features, several splitting nodes can write job chunks to the intermediary storage and several RIP engines can read the chunks as they are being written. Christiansen et al. does not provide the aforementioned functionality and thus uses a less efficient transfer system that does not teach the virtual disk transfer system of claims 1-3.

Christiansen et al. also does not suggest transfers that are made by transferring to an intermediary storage device and instead suggests that transfers are made directly via the local interface. Accordingly, where claims 1-3 advance a method where the job chunks of a split print job are first transferred to an intermediary storage device (the virtual disk) and then the assigned RIP engines transfer them from the intermediary storage device, Christiansen et al. transfers the entire job directly from the local memory of the RIP manager to the local memory of the RIP engines.

Furthermore, since each RIP engine under Christiansen et al. maintains a local copy of the entire print job in its own local memory and print jobs are not initially split into job chunks, there would be no need for an intermediary virtual disk transfer system. The purpose behind the virtual disk transfer system is to allow quick, efficient dissemination of job chunks to the various RIP engines from what could be a plurality of splitters. Quick, efficient dissemination is achieved because individual RIP engines need only access the job chunks assigned and may further start accessing (transferring)

the job chunks before the splitter has even finished creating and writing the job chunks to the virtual disk transfer system. Christiansen et al., however, by requiring the direct transfer of the entire print job to the RIP engines and not splitting the print job into job chunks before transferring to the RIP engines defeats the purpose behind the virtual disk. RIP engines, will, at the very least, be delayed by the time taken to transfer superfluous information. (Paragraph 78, Fig. 16). For example, if a RIP node is assigned the last page of a 10 MB print job, it must wait while all the preceding pages are transferred before it may begin work.

Accordingly, given the shortcomings of Christiansen et al., in order for the combination of Christiansen et al. and Kobayashi et al. to teach or suggest the method of claims 1-3, Kobayashi et al. must teach an intermediary virtual disk transfer system providing a transparent networked file system interface and blocking reads before end of file. Kobayashi et al., however, teaches a local caching system with redundancy in case of power failure. It does not teach or suggest a virtual disk transfer system wherein a transparent memory interface for the remote transfer and storage of print data is utilized. While Kobayashi et al. does share characteristics with claims 1-3, such as monitoring the size of a RAM cache and paging data in and out of the RAM cache, said shared characteristics do not teach or suggest a system for transferring data. They, at most, teach or suggest a RAM disk. Since a virtual disk is defined by features beyond those of a traditional RAM disk, such as a transparent networked file system interface, the combination of Christiansen et al. and Kobayashi et al. does not teach or suggest the present invention. The combination instead teaches or suggests a system wherein the RIP manager and the RIP engines each have their own local RAM disks and data is transferred directly without use of an intermediary storage device.

For at least the foregoing reasons, claims 1-3 are not anticipated and obvious in light of Christiansen and Kobayashi.

CONCLUSION

Claims 1-3 remain in the application. Claim 1 has been amended. For at least the reasons detailed above, Applicants submit that all claims remaining in the application (Claims 1-3) are now in condition for allowance. Accordingly, Applicants

request an early indication thereof. The foregoing comments do not require unnecessary additional search or examination.

No additional fee is believed to be required for this After Final Amendment. However, the undersigned attorney of record hereby authorizes the charging of any necessary fees, other than the issue fee, to Xerox Deposit Account No. 24-0037.

This is an authorization under 37 CFR 1.136(a)(3) to treat any concurrent or future reply, requiring a petition for extension of time, as incorporating a petition for the appropriate extension of time.

In the event the Examiner considers personal contact advantageous to the disposition of this case, he/she is hereby authorized to call Patrick R. Roche, at Telephone Number (216) 861-5582.

Respectfully submitted,

FAY SHARPE LLP

July 21, 2008
Date

Patrick R. Roche, Reg. No. 29,580
1100 Superior Avenue, Seventh Floor
Cleveland, OH 44114-2579
216-861-5582

N:\XERZ\201650\3B\XERZ 201650-3-3.docx